STUDIES IN PRIMITIVE LOOMS.

[WITH PLATE XII.]

By H. LING ROTH.

I.

1.—INTRODUCTION AND DEFINITION OF TERMS.

A GREAT deal has been written about primitive weaving tools, and if I add to the quantum it is partly because I venture to think I have something new to say, and partly because I wish to bring to the notice of travellers and students at home and abroad the necessity for gathering further, and above all correct, information on the subject before it is too late. There is nothing so annoying as the crude descriptions we are supplied with, when a little care could and should bring us invaluable knowledge; and as to the illustrations, the authors seem to hide just that which is the most important for us to see. Here in England, in the greatest textile-producing country in the world, we still evince little interest in the subject. Quite recently the publishers of the *History of the Nations* illustrated an impossible loom which they depict as coming from Babylonia—an absolute and deliberate piece of fiction which could not have been foisted on the public if it had known something definite about primitive looms.

Weaving is generally considered to be the outcome of basketry and mat-making, and in most cases probably it is so. It consists of the interlacing at right angles by one series of filaments or threads, known as the *weft* (or *woof*) of another series, known as the *warp*, both being in the same plane.

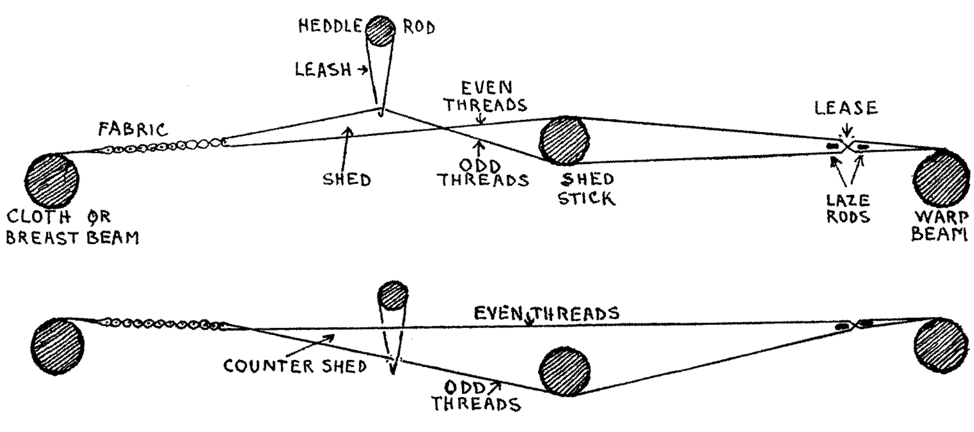
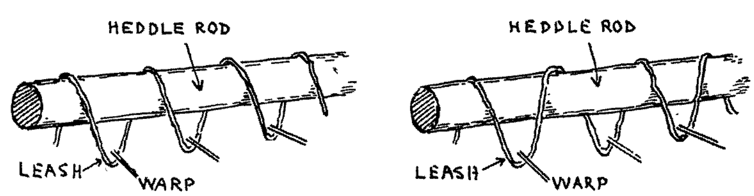


FIG I. DIAGRAM TO ILLUSTRATE THE PRINCIPLES OF WEAVING

The warp threads are stretched side by side from a *cloth*, or *breast-beam*, to another beam known as the *warp-beam*, often spoken of as *the beam*, and the weaving is encompassed as follows (see Fig. 1): The *odd threads* (1, 3, 5, 7, 9, etc.) are raised by means of the fingers, leaving the *even threads* (2, 4, 6, 8, 10, etc.) in position. By raising the odd threads only, a space or opening is formed between the two sets of threads, which is called the *shed*. Through this shed the weft thread is passed, or, as it is termed, a *pick*, or *shot*, is made. This weft thread (or pick) is straightened and pressed home into position at right angles to the warp by means of a *sword*, or *beater-in*. The odd threads are then dropped back into position, and the even threads are now raised instead, whereby a new or *countershed* is produced and the pick made as before. It will be understood that, as a consequence of the lifting and dropping of the odd and even threads, these two sets of threads cross each other, but remain in their respective vertical planes. This crossing keeps the pick in position.

To make the work easier and more expeditious a rod, the *heddle-* or *heald-rod*, is placed across the warp; to this rod the odd warp threads are lightly attached by a series of *loops* or *leashes*, so that when the rod is raised all the odd threads are raised *together* instead of singly by the fingers, and through the shed so formed the pick is made. When the rod is dropped, the odd threads fall back into position between the even threads. But as the even threads are now not raised, the odd threads must be made to fall below the even threads to make the next or countershed. The odd threads are therefore pulled down once over by the fingers, and in the countershed so made a thick rod or *shed-stick* is inserted. This shed-stick remains in this position until the whole warp is used up, or, in other words, the piece of cloth is woven, and its action may be described as follows: When the heddle is raised, the pick made, and the heddle dropped again, the shed-stick, owing to its thickness, forces the odd threads below the even threads, and so the countershed is obtained. Later on a flat stick has come into use, which is kept flat to the warp when the heddle is raised, but set on edge when the heddle is dropped, whereby the shed is enlarged and the pick facilitated. Later still, double heddles and counter heddles, with their *harness* and *treadles*, were introduced, but these can be dealt with as they arise.



SPIRAL FORM FIG. 1A. ALTERNATE FORM

The heddle leashes are either single or continuous. If single (that is, if every leash is made of a separate piece of filament, spun or non-spun), the leashes are often bunched together, as in the African raphia looms, or every leash is tied up separately, as in more advanced looms. If continuous (that is, one long filament serves for making all the leashes required), then the leashes are either *spiral* or *alternate,* as shown in the illustration Fig. 1A. "Spiral" means that the filament is wound loosely round the heddle-stick, and "alternate" means that the filament laps over the sides of the heddle-rod alternately.

The difficulty experienced in keeping the warp threads from getting entangled one with another, especially when these threads are long and the cloth to be woven is broad, is overcome by crossing them with one or two pairs of rods. The odd threads (more or less close to the warp beam) are raised, and one rod passed through the shed; then the even threads are raised and the other rod passed through. This arrangement causes friction, and the warp threads are unable to move laterally, and hence retain their position and do not tangle. This crossing of the warps is called a *lease,* and hence the rods are called the *lease-rods,* corrupted into *laze-rods.* Laze-rods are, in so far as my studies go, found at the present day on nearly all primitive looms, although in the quite early stages the warps are more or less bunched at the lease, and do not require any laze-rods.

Another method of keeping the warp threads in position is the *warp-spacer,* known also as a *raddle.* It appears to have been in use in Egypt.[1] It is provided with pegs or teeth, between which the warp threads are passed in various definite quantities. The space *between* the teeth or pegs is called a *dent* by weavers, although the loom-makers call the tooth or peg the dent; as we are dealing with weaving and not with machine-making, it will be as well to adhere to the users' definition.

In course of time the beater-in was supplanted by a comb-like article which developed into the *reed* and later still into the *sley,* a tool which drives home the weft as well as keeps the warp in position. I say "supplanted" advisedly, as so far I cannot trace any evolution in the matter, and, judging by specimens of reeds from the Philippines and Borneo, the reed was originally a form of warp-spacer, and ultimately became a beater-in as well. But in any case the reed appears to have made its appearance very late.

There is a third method which consists in fixing the warp threads separately on the beams by means of a heading or tailing thread, but this is only effective on short looms.

Now as to the meaning of the word *loom.* According to the *New Oxford Dictionary* it is of obscure origin, and meant in the first instance "an implement or tool of any kind," now applied to "a machine in which yarn or thread is woven into fabric by the crossing of threads called respectively the warp and weft." Some writers only apply the term loom to the frame when it refers to weaving in which the shed is no longer obtained by means of the fingers (or a pointed stick or a spool point), but by mechanical means, viz., the heddle. But I think that as long as a fabric, *i.e.*, anything woven in the accepted signification of the term, is obtained,

[1] See *Ancient Egyptian and Greek Looms,* by H. Ling Roth, Halifax, 1913, p. 20.

the frame on which it is obtained had better be called a loom, and in that sense I use it in these studies.

2.—THE EVOLUTION OF THE SPOOL AND SHUTTLE.

There seems some confusion as to what is a spool or bobbin, and as to what is a shuttle, nor is it at first sight quite easy to draw a hard and fast line. I should describe a spool or bobbin as a quill or small cylindrical shaft on which the weft is wound for the purpose of weaving, and a shuttle as an instrument for the same purpose, consisting ultimately of a more or less boat-shaped *case containing a spool.* In the accompanying diagram (Fig. 2) I have made an attempt to portray the evolution of both from a single short filament. The lines of evolution seem to be three:

(*A*) One in which the filament is wound round the spool more or less lengthwise, *i.e.*, parallel to the axis of the spool;
(*B*) the other in which the filament is wound more or less at right angles to the axis of the spool; and
(*C*) the third, in which the attachment can be likened to the threading of a needle, as in the Iceland specimen, or where instead of a needle eye there is a slot, as in the African beater-in and spool combined. As regards this African tool, the slot points away from the body or blunt end of the tool, hence it would appear that it is pushed through the shed, and when it emerges at the other side the filament is put into the slot and the spool withdrawn the way it entered, leaving the filament in its place. There are some more advanced forms of the African beater-in and spool combined, which have the slot pointing both ways.

Evolution along the line *A*: From winding the weft lengthwise and covering the spool almost to its very ends, which are rounded or cut off straight at first, we find the ends become grooved as in the Slave Indian specimen *Ab*, and gradually as the grooves deepen the now double ends appear to lengthen, *Ab*1, and take the shape of horns as with the Ainu spool *Ab*2; then these double ends incline towards each other like those of our fishermen's mesh-pin or needle, and finally recurve backwards as in the second Ainu example *Ab*3.

At the same time as a branch development the rounded sides of the spool become flattened and in turn become grooved so that there is a longitudinal groove as well as an end one, that is to say, the groove is continuous; this is seen in the Santa Cruz specimen *Ad*1, and still more so in the Iban specimen *Ad*2, which is practically the same, only on a larger scale, as our well-known English ladies' tatting shuttle, so called.

On the line of evolution *B* with its transverse winding at right angles to the spool, the resultant bulginess attained by this method of winding may have necessitated a cover or case to facilitate the making of the pick. As a first form of such a case we have in the Malay specimen *Bb* a piece of cane cut off at a node

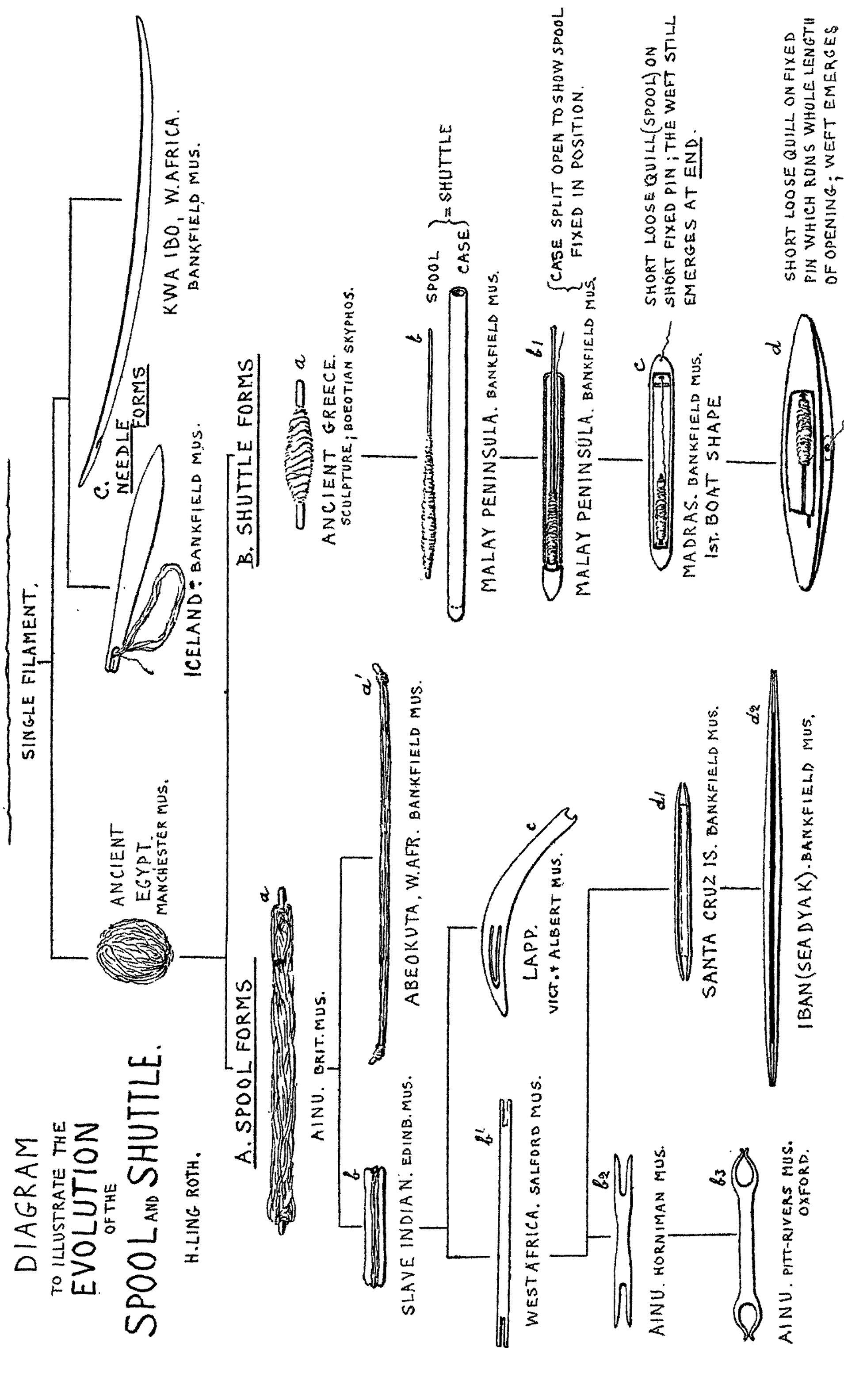


DIAGRAM TO ILLUSTRATE THE EVOLUTION OF THE SPOOL AND SHUTTLE.
H. LING ROTH.
SINGLE FILAMENT.
ANCIENT EGYPT. MANCHESTER MUS.
A. SPOOL FORMS
a
AINU. BRIT. MUS.
a'
ABEOKUTA, W. AFR. BANKFIELD MUS.
b
SLAVE INDIAN. EDINB. MUS.
b'
WEST AFRICA. SALFORD MUS.
b2
AINU. HORNIMAN MUS.
b3
AINU. PITT-RIVERS MUS. OXFORD.
c
LAPP. VICT. & ALBERT MUS.
d1
SANTA CRUZ IS. BANKFIELD MUS.
d2
IBAN (SEA DYAK). BANKFIELD MUS.
B. SHUTTLE FORMS
a
ANCIENT GREECE. SCULPTURE; BOEOTIAN SKYPHOS.
b
SPOOL
CASE
= SHUTTLE
MALAY PENINSULA. BANKFIELD MUS.
b1
MALAY PENINSULA. BANKFIELD MUS.
CASE SPLIT OPEN TO SHOW SPOOL FIXED IN POSITION.
c
MADRAS. BANKFIELD MUS. 1ST. BOAT SHAPE
SHORT LOOSE QUILL (SPOOL) ON SHORT FIXED PIN; THE WEFT STILL EMERGES AT END.
d
SHETLANDS BANKFIELD MUS.
SHORT LOOSE QUILL ON FIXED PIN WHICH RUNS WHOLE LENGTH OF OPENING; WEFT EMERGES AT SIDE.
C. NEEDLE FORMS
ICELAND. BANKFIELD MUS.
KWA IBO, W. AFRICA. BANKFIELD MUS.

FIG. 2.

which has been slightly rounded. In this the spool is placed, not fixed, and the weft unravels from the open end. A development of this consists in making the blunt end pointed, or making a point of gum or of some other resinous substance, as in another Malay specimen not shown. Later on this point is replaced by a wooden stopper with an internal socket, into which the spool is rammed, and so gets fixed as in a third Malay specimen *Bb*1. Then to ease the unravelling in the tube the spool is shortened, for the case is now held by the hand instead of the spool being held, and further to assist supervision the upper longitudinal half of the cane case appears to have been cut away, the end plugged and perforated, to guide the outgoing weft, and we get the first shuttle as known to us in the boat form with the weft still running out endwise as in the Madras specimen *Bc*. There is, however, an objection to the end outlet, inasmuch as a shuttle so provided has to be turned round at the end of every pick, hence the outlet for the weft was made at the side instead, while the spool was made to fit the full length of the case opening in the shuttle *Bd*, and this is the general form the shuttle practically retains at the present day.

The longitudinal method of winding the thread on the bobbin, *i.e.*, method *A*, is evidently due to the fact that owing to its slender shape the spool passes easily through the shed. On the other hand, the thickness resulting with method *B* makes the pick more difficult, a difficulty which was overcome by the use of a case, the adoption of which was facilitated by the shortening of the spool.

In order to test this I had a wooden spool made 22 inches (or 56 cm.) long and $\frac{9}{16}$ inch (or 14 mm.) in diameter, and had it carefully wound round with 200 yards of thread according to method *A*; this covered the spool to a length of 21 inches (or 53 cm.), and increased its diameter to $\frac{3}{4}$ inch (or 19 mm.). Then another spool of wood was obtained $8\frac{1}{2}$ inches (or 21 cm.) long, and also $\frac{9}{16}$ inch (or 14 mm.) in diameter; 200 yards of the same thread was wound round this according to method *B*, covering the spool to a length of $3\frac{1}{2}$ inches (or 8·9 cm.), and increasing its diameter to $1\frac{3}{8}$ inches (or 35 mm.). It is therefore evident that by the method *A* the same quantity of thread can be carried through a small shed with greater ease than can be carried through by method *B*. In connection with this I find also, generally speaking, the method *A*, the longitudinal method, is in use only with the more primitive forms of loom, *i.e.*, those in which the countershed is still made by a shed stick, and where consequently the shed is not so clear, nor opened so widely, as in looms provided with counter heddles and treadles. In other words, the improvement in the loom permitted improvement in the spool, which led to the evolution of the shuttle.

According to the explanation given in the *New Oxford Dictionary*, the origin of the word bobbin is unknown, but we are informed that Cotgreve, writing in 1611, calls it "a quil for a spinning wheele." The word spool is merely another term for bobbin, is of Teutonic origin, and is also applied "to the mesh-pin used in net-weaving." As regards the word shuttle, the same dictionary tells us that primarily it meant a "dart, missile, arrow," an explanation which appears to me to designate correctly the quality which distinguishes it from the spool, for I have found it easier to shoot through a shed with a shuttle than with a spool. It was no doubt this shooting capacity which led Kaye to invent the flying shuttle in 1733.

To come back to the Dictionary, we find it says: "The normal form of the shuttle resembles that of a boat, whence its name in various languages (L. *navicula*, F. *navette*, G. *Webeschiff*)." As regards the French and German interpretations the Dictionary is most probably correct, but not so as regards the Latin interpretation. Asking Professor T. F. Tout, Manchester University, for assistance in the explanation of the extended meaning of the word *navicula*, he kindly replied, saying, "*Radius* and *pecten* are the ordinary classical words for shuttle," and quoted the well-known lines in Virgil: *Arguto tenues percurrens pectine telas* (as she runs over her delicate web with the nimble spool), *Æn.*, VII, 14. He continued, "The ordinary dictionaries, *e.g.*, Lewis and Short, do not give *navicula* in the sense of shuttle at all. Ducange, s.v. *navicula*, quotes Ugotio (a twelfth-century writer, I *think*), *Radius instrumentum texendi, scilicet pecten vel navicula* (Bobbin, an instrument for weaving, that is a quill or shuttle), a good passage for your purpose. The French *navette* is also used in the thirteenth century in its modern sense of shuttle. This is as far back as my reference books give the word. If one had time, no doubt earlier instances could be found, but *navicula* is certainly post-classical for shuttle, though probably earlier than the twelfth century. This helps your point that early shuttles were not like little boats."

Blümner, in his great work,[1] after describing κερκις (spool), as used by the Greeks, continues: "But, apart from this, Homeric times seem to have known the real shuttle, in which the weft is wound round a spool inside and unravels through an opening in the shuttle when it is thrown. In the above-mentioned passage in Homer—viz., *Iliad*, XXII, 760—it is stated of the female weaver: πηνίον ἐξέλκουσα παρὲκ μιτον (drawing the spool across the web); here πηνίον takes the place of κερκις. This πηνίον we also meet with elsewhere, yet it cannot be considered identical with κερκις, but is explained by acknowledging that the spool within the shuttle is referred to." But why? I ask. The passage is clear enough without such an inference. Blümner then quotes various forms of πηνίον and its application, but there is not in any one of his quotations any description which can in the remotest way be applied to a shuttle. He also quotes in support of his contention the well-known post-classical fourth century A.D. lexicographer Hesychius, who most probably had seen a shuttle at the time of his writing; but while this authority does distinguish between the spool and the shuttle, this does not prove the existence of the shuttle some 1100 or 1200 years before his time. Marquardt[2] says πηνίον is the weft (the *Eintragfaden*), and this fits the passage well enough, "drawing the weft across the web"; spool and weft are equally correct. It seems as

[1] *Techn. u. Term. der Gewerbe u. Kuenste bei Griechern u. Roemern*, 1st vol., 2nd ed., Leipzig, 1912, pp. 152–3.

[2] *Das Privatleben der Roemer*, Leipzig, 1879, p. 504, note 7.

though Blümner, having given his opinion that in Homer's time the shuttle was known, is attempting to give a new reading to the word πηνίον in order to sustain his contention. He is, however, misled by an illustration (the bottom central one of Fig. 160 on p. 157 of the *British Museum Guide to the Exhibition illustrating Greek and Roman Life*, which he takes to be a shuttle (*Webeschiffchen*), but which is in reality the grooved spool of type *Ad*1 of my diagram, and most decidedly *not* a shuttle.

The noise made by the shuttle and referred to in the classics is also brought in as a proof of the existence of the tool at the period named. A purposely obscure passage in Aristophanes' *Frogs*, 1316, quoted by Marquardt, p. 509, note, reads:—

ἱστότονα πηνίσματα
κερκίδος ἀοιδοῦ μελέτας,

"the weft stretched on the web beam—the care of the tuneful shuttle." What is a tuneful shuttle? And in the quoted passage from the *Æneid* we are treated to the "singing" of the shuttle. In this case we have an alternative for *arguto* (singing), by translating it "deft" or "nimble," and it would appear that if "nimbleness" be accepted, it must be on account of poetical licence—and we are dealing with poets—in which the deftness of the weaver is transferred to her implement. On the other hand, there appears no other meaning for ἀοιδός than "tuneful," and with regard to the low state of musical culture among the Greeks, what may have been tuneful to them is most probably not tuneful to us. The fact is, a noise was made during weaving and recorded, the recorder not being very precise as to whether the noise emanated from the tool which set the work in motion or from the loom. I have ascertained by experiment on various more or less primitive looms in Bankfield Museum, that some shuttles make no noise, while others do, and that, generally speaking, whether spools or shuttles are used, the noise the observer notes comes from the loom itself and not from the shuttle.

In their earlier periods the Greeks had vertical looms with warp weights, which possibly in later times were replaced by a lower or breast beam. As explained above, the shuttle evolved with the improvements of the loom. It evolved as other things evolve, as the opportunity or necessity for it arose. There was little opportunity, if any, and practically no necessity, for the shuttle on the warp-weighted loom of so primitive a construction as that possessed by the earlier Greeks. Hence, taking all the points into consideration, it appears to be an anachronism to infer that the shuttle existed in Homeric, or perhaps even in later Greek, times. What was used was still a spool.[1]

[1] Since the above was written I find that Otto Schrader (*Lingu.-hist. Forschungen zur Handelsgeschichte u. Warenkunde*, Jena, 1886, p. 182), as quoted by Franz Stuhlmann (*Ein Kulturgeschichtlicher Ausflug in den Aures* . . . Hamburg, 1912, p. 195), states: "Our shuttle was unknown to the Ancients." I have not been able to see a copy of Schrader's work.

3.—THE AINU LOOM.

The Ainu loom is a primitive affair, with characteristics well worth studying. It has not been described before to any extent except in a very crude and unsatisfactory way by Hugo Ephraim,[1] and hence I have chosen it as a fit subject for discussion.

FIG. 3.—AINU WOMAN WEAVING.
(After Romyn Hitchcock.)

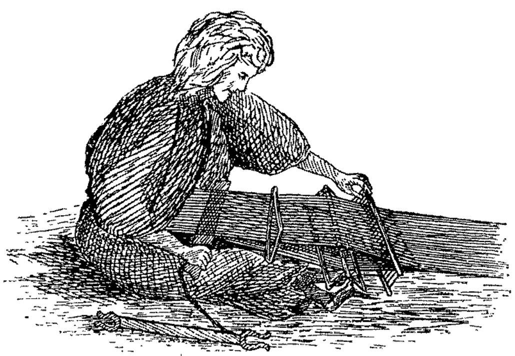


FIG. 4.—AINU WOMAN WEAVING.
(As reproduced by Ephraim, after Romyn Hitchcock. Note the distorted heddle and spool, and the gratuitous and incorrect addition of the feet.)

Both reduced by one-fourth lineal.

We are told by the Rev. John Batchelor that "the chief article of dress worn by the Ainu is a long garment which they call *attush.* This word really means elm fibre or elm thread, and, as the words indicate, the dresses are made from the inner bark of elm-trees. Such garments are very brittle when dry, but when wet they are exceedingly strong.[2] According to MacRitchie, in the legend descriptive of the illustration of Ainu peeling the bark off the tree, it is "*Microptelea parvifolia,* in Aino *ohiyo,*" but Hitchcock says the people use the bark of the elm (*Ulmus montana*), called by them *ohiyo,* and sometimes *U. campestris.*[3] Batchelor continues: "Elm bark is peeled off the trees in early spring or autumn, just when the sap commences to flow upwards or when it has finished doing so.[4] When sufficient bark has been taken, it is carried home and put into warm, stagnant water to soak. It remains here for about ten days till it has become soft; then, when it has become sufficiently soaked, it is taken out of the water, the layers of bark separated, dried in the sun, and the fibres divided into threads and wound up into

[1] "Ueber die Entwickelung der Webetechnik . . ." (*Mitt. a. d. städisch. Mus. f. Voelkerk. zu Leipzig*, 1905).

[2] *The Ainu and their Folklore,* Lond., 1901, 2nd ed., p. 144.

[3] "The Ainos of Yezo," *Rep. U.S. Nat. Mus. for* 1890, p. 463.

[4] "The men bring in the bark, in strips 5 feet long, having removed the outer coating" (Bird).

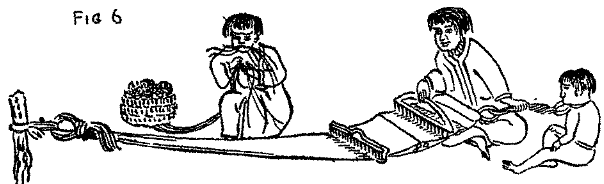
balls for future use. Sewing-thread is sometimes made in the same way, only it is chewed till it becomes round and solid. Sometimes, however, thread is made by chewing the green fibre as soon as taken from the trees. When all the threads have been prepared, the women sit down and proceed with their weaving."

Going a little more into detail, Miss Bird says: "This inner bark is easily separated into several thin layers, which are split into very narrow strips by the older women, very neatly knotted, and wound into balls weighing about a pound

FIG. 5

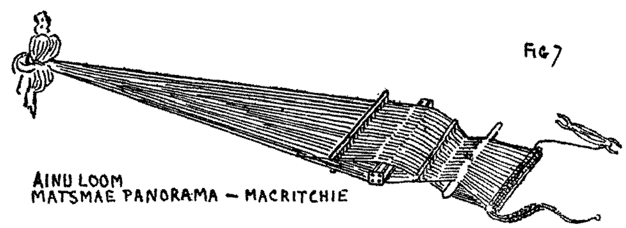
AINU STRIPPING BARK OFF ELMS. · YEZO-MANGA PICTURES—MACRITCHIE

FIG 6



AINU WEAVING. YEZO-MANGA PICTURES —MACRITCHIE

FIG 7



AINU LOOM MATSMAE PANORAMA — MACRITCHIE

each. . . . The loom consists of a stout hook fixed in the floor, to which the threads of the far end of the web are secured, a cord fastening the near end to the waist of the worker,[1] who supplies, by dexterous rigidity, the necessary tension; a frame like a comb resting on the ankles, through which the threads pass; a hollow roll for keeping the upper and under threads separate, and spatula-shaped beater-in[2] of engraved wood, and a roller on which the cloth is rolled as it is made. The length of the web is 15 feet, and the width of the cloth 15 inches. It is woven with great regularity, and the knots in the thread are carefully kept on the underside. It is a very slow and fatiguing process, and a woman cannot do much more than a foot (30 cm.) a day. The weaver sits on the floor with the whole arrangement attached to her waist, and the loom, if such it can be called, on her ankles. It takes long practice before she can supply the necessary tension by spinal rigidity. As the work proceeds, she drags herself almost imperceptibly nearer the hook. In this house and other large ones two or three women bring in their webs in the morning, fix their hooks, and weave all day, while others, who have not equal advantages, put their hooks in the ground and weave in the sunshine. The web and loom can be bundled up in two minutes, and carried away quite as easily as a knitted sofa

[1] This is the semi-girdle or backband. A. S. Bickmore (*Trans. Ethnol. Soc.*, vii, N.S., 1869, p. 18) speaks of it as a board. If so it is somewhat similar to the old-fashioned Japanese back-piece.

[2] Bird uses the word "shuttle" here, but it is evidently a clerical error.

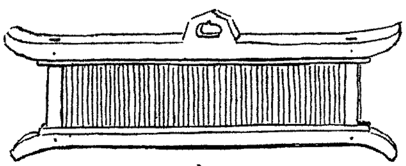
blanket.[1] Batchelor tells us the garments produced "are very rough indeed, reminding one of sackcloth, and are of a dirty brown colour. It is therefore no wonder that those Ainu who can afford it prefer to wear the softer Japanese clothing."

Simple as it looks, the Ainu loom is characteristic in all its parts except one, and this one, the semi-girdle or back-strap, appears to connect it with the looms of, generally speaking, the Pacific Region. The users of the back-strap are, or were, the Bhutiyas of N.W. India (specimen in Bankfield Museum), the Tibetans,[2] the Chinese,[3] Burmese and Assamese,[4] the Iban or Sea-Dyaks (Bankfield Museum), the Japanese,[5] Philippine Islanders,[6] the Koreans,[7] the Santa Cruz Islanders (Bankfield Museum), the Caroline Islanders, the Aztecs,[8] and Modern Mexican tribes (British Museum), and so on—a fairly wide circle of users. On the British Museum Ainu loom the back strap is of bark, on the specimens in the Horniman Museum and the Royal Scottish Museum, Edinburgh, it is of wood.

The Ainu, as observed, use non-spun bast filament in single strips both for warp and for weft. A similar non-spun filament, but in much broader strips, and on a much cruder loom, is used by the Kwakiutl Indians for mat-making.[9] The Santa Cruz Islanders use a non-spun filament for their warp, and a twisted filament or thread for the weft; what the latter is made of I have not been able to ascertain, but the warp is said to be obtained from the stem of a black banana![10] According to Lieut. Emmons, in the manufacture of the Chilkat blanket the inner bark of the yellow cedar (*Chamaecyparis nootkatensis*) and of the red cedar (*Thuya plicata*) is laid up in a two-stranded cord, so it is bast thread and not non-spun bast filament.[11] Otherwise the great field for non-spun filament used for weaving and drawn from the Raphia palm is the vast region of that palm's habitat in Africa. But beyond using a non-spun filament, there is nothing in common between the looms of Africa and the looms of the Ainu. In a Shan head-dress in Bankfield Museum some weft is of non-spun filament-like palm leaf splittings, and native cotton warp.

There does not appear to be any warp beam in the Ainu loom, a *warp peg* (Fig. 27) being used instead, and is driven into the ground, as is evident from the specimens in the British Museum, Royal Scottish Museum, Edinburgh, and Horniman Museum. Hitchcock does not mention any warp attachment, and Bird mentions the use of a hook.

1 *Unbeaten Tracks in Japan*, 4th ed., Lond., 1881, ii, 92.
2 W. H. S. Landor, *Tibet and Nepal.*
3 Falcot, *Traité*, 1852, Pl. 224.
4 Joyce and Thomas, *Women of All Nations.*
5 v. Bavier, *Japan's Seidenzucht*, Pl. IV, Fig. 3.
6 Worcester, *Philippine Journ. Sci.*, I.
7 Cavendish, *Corea and the Sacred White Mountain.*
8 Kingsborough's *Mendoza Codex.*
9 M. L. Kissel, *Aboriginal American Weaving.*
10 Florence Coombe, *Islands of Enchantment*, London, 1911, p. 175.
11 "The Chilkat Blanket," *Mem. Amer. Mus. Nat. Hist.*, iii, p. iv, Dec., 1907.



WARPSPACER AINU BRIT. MUS.
FIG. 8.

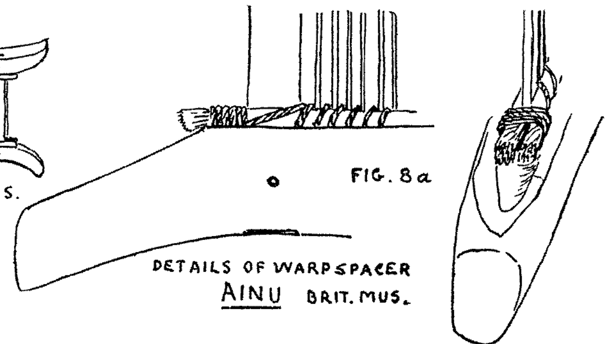
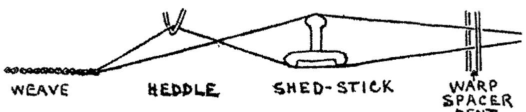


FIG. 8a
DETAILS OF WARPSPACER AINU BRIT. MUS.



AINU BRIT. MUS
FIG. 9.

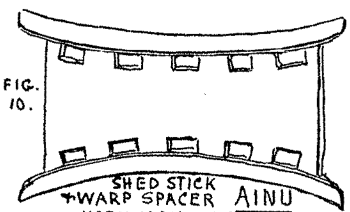
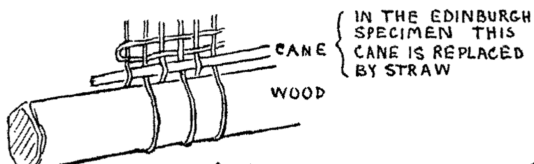
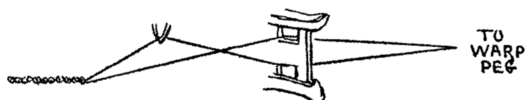


FIG. 10.
SHED STICK + WARP SPACER AINU HORNIMAN MUS.



BREAST BEAM AINU BRIT. MUS
FIG. 11



AINU. HORNIMAN MUS
FIG. 12

SHED STICK
FIG. 13. AINU. HORNIMAN MUS.

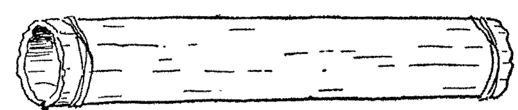
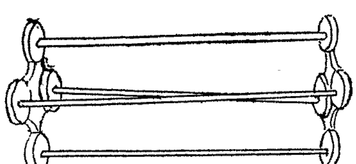


FIG. 14. AINU EDINB. + GLASGOW SHED STICK



SHED STICK AINU
FIG 15 BATCHELOR 1892

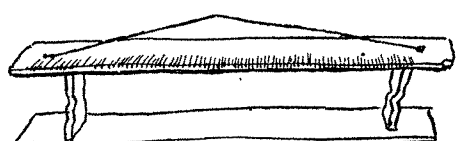
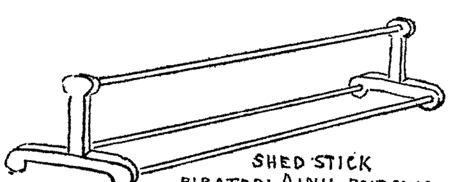
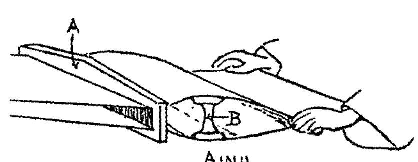


FIG. 16. SHED STICK AINU EDINB. MUS



SHED STICK
FIG. 17 PIRATORI AINU. BRIT. MUS



A. WARP SPACER
B. SHED STICK
AINU BATCHELOR. 1892.
FIG 18

At the breast or *cloth beam* there is a heading rod (Fig. 11), as shown in the illustration; in the Royal Scottish Museum specimen the heading rod is made up of several pieces of straw, and in the British Museum specimen it is a piece of cane.

The warp length in the British Museum specimen is 14 feet (or 4·25 m.) from beam to beam, with a width of fabric of $10\frac{1}{2}$ inches (or 26·5 cm.) and about 16 picks

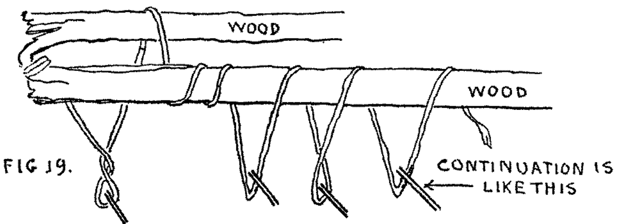
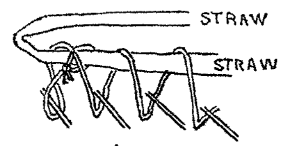
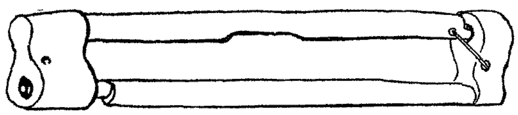


FIG 19. HEDDLE AINU BRIT. MUS



HEDDLE AINU HORNIMAN MUS. FIG 20.

FIG. 22 GENERAL FORM OF AINU BEATER-IN



HEDDLE. AINU EDINB. (CF. HITCHCOCK) FIG. 21.

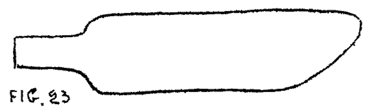
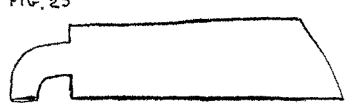
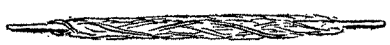


FIG. 23

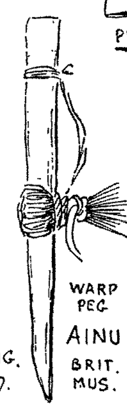
PEKA-O-NIT (SEE TEXT) AINU BATCHELOR. 1901. FIG. 24



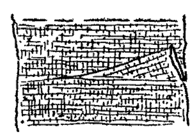
PUEBLO BEATERS-IN O. MASON PL. 9.



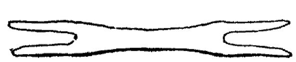
SPOOL AINU EDINB. FIG. 25



WARP PEG AINU BRIT. MUS. FIG. 27.



RECTIFICATION OF BAD WEAVING AINU BRIT. MUS. FIG. 28.



SPOOL AINU HORNIM. MUS. FIG 26.

to the inch (or 7 to the cm.). In the Royal Scottish Museum specimen, the warp is many feet long with a fabric width of $12\frac{1}{4}$ to $12\frac{1}{2}$ inches (or 31 to 31·7 cm.). In the Horniman Museum narrow loom the length of the warp is 8 feet 10 inches (or 2·7 m.) with a fabric width of $1\frac{7}{8}$ to 2 inches (or 5 cm.).

The warp and weft are both continuous. Bird mentions that the knots on the warp and weft are kept well out of sight; this is, however, not always the case.

The only *pattern* I have seen in these cloths is one formed by the introduction of blue, green and white Japanese cotton warp threads in the centre of the work. Bickmore also mentions this.[1]

The Ainu horned *bobbin* (Fig. 26) is called *ahunka-mit;* as shown in the diagram of the development of the spools it will be seen that these people follow method *A* in its various stages.

The *heddle*, for which I cannot find the native name, is of the single lifter type (Figs. 19 and 20), and like all other parts of the loom, varies considerably. In the British Museum specimen it consists of a piece of stick bent double; in the Horniman Museum specimen it is a piece of straw bent double; in the Pitt Rivers Museum, Oxford, it is a plain cylindrical rod. In the Royal Scottish Museum, Edinburgh, one specimen (Fig. 21) is a rectangular frame made up of two shaped pieces, the leashes hanging from the lower rod, while the lower side of the upper rod is cut away for a hand grip. This form is somewhat similar to that illustrated with a woman at work, by Hitchcock (Fig. 3), but which has been distorted out of all semblance by Ephraim (Fig. 4). In the Matsmae panorama (Fig. 7), reproduced by David MacRitchie,[2] the heddle looks to be a plain rod with its leashes as in the Pitt Rivers Museum, Oxford, while in the Yezo-Manga pictures (*ibid.* Plate XVII) the rod has a bow handle (Fig. 6).

The heddle leashes are of coloured Japanese thread.

The *shed-stick, kamakap,* is peculiar throughout, and in some forms quite different from that used by any other peoples in so far as my enquiries go. One form (Fig. 13) consists of three cylindrical rods, which fit at their ends into circular plates as in the Horniman Museum specimen; others, in the British Museum (Fig. 17) and Pitt Rivers Museum, Oxford, have the end plate made like an inverted ⊥; while Hitchcock's illustration (Fig. 3) shows the end plate as an inverted Λ. The Yezo-Manga (MacRitchie, Plate XVII) drawing (Fig. 6) shows three rod ends without any plate, which is evidently an oversight. Sometimes there are four rods as shown by Batchelor (Fig. 15), which fit into a fancy end plate, or they are fitted into a square plate as indicated in the Matsmae panorama (MacRitchie, Plate IX) (Fig. 7). In the Royal Scottish Museum, and in the Glasgow City Art Gallery and Museum, there are specimens of the shed-stick, made out of lengths of the stem of the rice paper plant, *Fatsie papyrifera* (Fig. 14), as kindly identified for me at the Royal Botanic Gardens, Kew—evidently similar to the one mentioned by Bird. To preserve the ends from splitting, they are bound with bast filament. Still a different form is exhibited in the Royal Scottish Museum, Edinburgh (Fig. 16). It looks like a miniature bench, and is much scored by the friction of the warp threads in making the sheds. It is shown end on in one of Batchelor's illustrations (Fig. 18), reproduced herewith. There is also a shed-stick and warp-spacer combined, and this I will refer to presently.

The Ainu evidently make mistakes like other people. In the British Museum

[1] *Trans. Amer. Journ. Science*, 1856.
[2] *The Ainos*, Suppl. to vol. iv, *Archiv Intern. d'Ethnographie*, 1892, Pl. IX.

specimen (Fig. 28), at a distance of about $1\frac{1}{2}$ in. (or 4 cm.) from the breast beam, the weaver had got much of the weft not at right angles to the warp, owing to the faulty position of the breast beam. In order to remedy this, she has made a triangular pleat of the faulty portion, stitched it back on to the fabric, and so, getting the last few picks correctly at right angles to the warp, proceeded with her work.

We now come to another peculiar feature of the Ainu loom, viz., the *warp-spacer* or *osa*. The osa appears to exist in one of two forms, in all specimens and illustrations of Ainu looms, and in one form (Fig. 8) it resembles the well-known *reed*, which is a beater-in and warp-spacer combined. But the Ainu use this tool as a warp-spacer only, and therefore invariably place it between the warp-peg (beam) and heddle, instead of between the heddle and the fabric. When in use, two filaments (sisters) are passed through each dent. This reed-like osa, from its make and from its position, indicates want of appreciation of its double function. The other form of osa (Fig. 10) used, in the Horniman Museum specimen of an Ainu loom for making a narrow fabric, is simpler in every way. It consists of a single flat piece of wood cut to shape, and is provided with one row of upper holes and one row of lower holes through which bundles of wárp filaments are passed and by means of which the osa acts as a primitive warp-spacer. This perforated board-osa is incomparably simpler than the reed-like osa, and therefore most probably preceded the latter. In adopting the reed-like osa, which they probably did from outside, the Ainu seemed to have grasped the idea that it was better than their pattern, but evidently either did not grasp its use as a beater-in, or else found that there was not much benefit to be gained by adopting it with the filament they used.

It is to be observed that the Ainu do *not* make use of *laze-rods,* and are apparently among the few primitive weavers who dispense with this tool, the place of which seems to be taken by the osa. As already mentioned, the Ainu use a *shed-stick and warp-spacer combined,* and this is the board-like osa (Fig. 12) in the Horniman Museum specimen. It is a combination I have not observed in any other primitive loom.

The *beater-in,* or *sword, attush bera* (Fig. 22) has the shape of a very broad-bladed knife; in fact, its breadth is its distinguishing feature. I know of no other such broad beater-in on the Asiatic side of the Pacific. Otis Mason calls attention to this beater-in, whose broad batten with a handle is similar to some of those found in the Pueblo region.[1] He gives some illustrations, two of which (Fig. 23), most like the Ainu beaters-in, I reproduce. He does not say whether both edges are equally adapted for the work, as is the case with the Ainu tool. Altogether the Pueblo tools appear to be thick along one edge, and hence similar to one from ancient Peru in Bankfield Museum, and consequently not so similar to the Ainu tool as might be thought at first sight. On the other hand, the existence of the haft may be a connecting link. Batchelor illustrates a tool (Fig. 24), and says it is called *peka-o-*

[1] "A Primitive Frame for Weaving Narrow Fabrics," *Rep. U.S. Nat. Mus.*, 1899, p. 510.

nit, and is used for the purpose of changing the warp threads. Does he mean that it is a primitive heddle ?[1]

The forms of the constituents of the Ainu loom are thus seen to be in part apparently local and in part similar to those in use elsewhere. The following summary shows this more clearly, but in studying them it must be borne in mind that this investigation makes no claim to be exhaustive and that negative evidence taken by itself is always liable to be upset.

Ainu Constituents.	*Presence or Absence elsewhere.*
Warp filament non-spun ...	Present in North America, Oceania, Central Africa.
Weft filament non-spun ...	Present in N. America, Cent. Africa, Indo-China.
Back-strap	Present in Eastern Asia and Archipelago, Oceania, America.
Spool or bobbin	Present in various stages of form *A* in Asia, America, Europe, and Africa.
Warp-spacer (Fig. 8) ...	Present as reed in Asia, Europe, and parts of Africa.
Sword or beater-in	Doubtful similarity in North and South America.
Heddle-rod	Same distribution as back-strap, also in Africa in places where cotton weaving has been introduced without the reed.
Heddle-rod frame (Fig. 21)...	Absent elsewhere.
Shed-stick	Present in some forms elsewhere.
Shed-stick and warp-spacer (Figs. 10 and 12).	Absent elsewhere, except perhaps in America.
Warp-peg without warp-beam	Present in Africa.
Laze-rods *absent*	Absent (?) in America occasionally.

The question arises, Did the Ainu invent any of the above loom constituents apparently peculiarly their own ? To enable us to form any opinion, we must get some notion of their capacity for development or invention, which at a time when they have been driven into cold northerly regions and more or less completely cut off from any outside stimulus except that of their conquerors, is somewhat difficult to do. Judging from the statements made by eye-witnesses and students, the Ainu do not show any capacity for improvement. Von Brandt, German Consul-General for Japan, writing forty years ago on the contact between the Ainu and Japanese, says:—"The Ainos, in spite of this contact, continuing for thousands of years, have adopted nothing from the Japanese ; they are what they were—a race standing at the lowest stage of culture, and probably also not capable of

[1] In the first edition of his book the names of two of the constituents have in error been transposed.

civilization. . . ."[1] A very sweeping assertion; nor have we any means of proving that the contact has continued for thousands of years, and it is obvious to any student that the Tasmanians, Australians, Fuegians, and Punans stood or stand on a lower stage than the Ainu.

A more recent investigator, Romyn Hitchcock, already quoted, is almost equally severe, saying:—"The Aino in close touch with Japanese civilization remains, intellectually and otherwise, as much a savage in culture to-day as he ever could have been. . . . They now use Japanese knives instead of stone implements and metal arrows in place of flints. But it is scarcely a century since they emerged, and otherwise they have not passed beyond it. . . . The Aino has not so much as learned to make a reputable bow and arrow, although in the past he has had to meet the Japanese, who are famous archers, in many battles" (p. 433). As to the bow and arrow, we meet with a flat contradiction from the pen of B. Douglas Howard, according to whom the Ainu are good shots and make a good bow, which at about forty to sixty feet range could be almost as effective as a rifle.[2] This was in Sakhalien, where the Ainu are free from Japanese oppression. It is going a long way beyond our experience of the evolution of culture to expect that a Stone Age people coming into hostile contact with the much higher metal-using civilization of a more fecund race should adopt some of the latter's culture, especially when, as in the case before us, the Japanese have until recent years been quite oblivious to the interesting character of the Ainu, and have treated them accordingly—in other words, oppressed them rigorously.[3] The Ainu are flesh-eaters, but the Japanese do not allow them to kill the native deer, and have taken their fish stations away from them, forcing them to become vegetarians.[4] Such treatment must tend to degeneration, yet, in spite of it, the Ainu have adopted some tools and methods from their oppressors.

Batchelor informs us the Ainu now use Japanese matches instead of obtaining fire by friction with elm roots, and later with flint, and flint and steel, also that they use Japanese razors instead of sharp flints and shells for shaving purposes (*op. cit.*, pp. 47, 139, 149), while Hitchcock has shown that they have discarded flint arrow heads for Japanese steel ones. The Ainu have also introduced Japanese warp threads into their looms. These adoptions apparently needed little mental effort, but, judged by their stage of culture, greater than we can perhaps conceive. It is progress in a slow way. They have gone a big step further, for, as A. S. Bickmore recorded some fifty years ago, they had begun to *work* iron, a very remarkable action for a Stone Age people.[5] The advance so made is still due to contact, but it argues ability for improvement in that they understand there are

[1] *Journ. Anthrop. Inst.*, iii, 1874, p. 132.
[2] *Life with Trans-Siberian Savages*, London, 1893, p. 80.
[3] It will be understood, of course, that I am speaking of the *past*.
[4] Batchelor, 1901 ed., pp. 17–18.
[5] "Some Notes on the Ainu," *Trans. Ethn. Soc.*, vii, N.S., 1869, p. 17.

ways superior to their own, and are prepared to make an effort to attain the new object.

Further light may possibly be gathered from an examination of their cranial capacity. From the measurements of seven Ainu skulls in the Museum of the Royal College of Surgeons, London, kindly supplied to me by Professor A. Keith, F.R.S., it appears that the average content is 1509 c.c., with a variation from 1400 to 1630 c.c., results which Professor Keith informs me are somewhat on a par with those of the average European. Most students who have gone into the question of the relation of the size of the brain to its intelligence would probably agree that in bulk the size of the brain is an index to at least potential mental ability. From this we may conclude that the Ainu may be quite capable of improvement.

The persistence in the use of the non-spun bast filament and the presence of varied forms of shed-stick and the absence of laze-rods point to isolation, and the varied forms of the shed-stick also point to progress.

If to the above points tending to show that there is a potentiality for progress and to the actual record of progress we add the otherwise doubtful negative evidence that certain constituents of the Ainu loom are not found elsewhere, we may, I think, acknowledge that these constituents are indigenous to the Ainu, and not due to contact.

4.—Some American Looms.

1. In the Royal Scottish Museum, Edinburgh, there is a specimen of a loom obtained from the North American Slave Indians with a porcupine quill fillet in the process of making. In a previous paper[1] I described some of the methods employed by the North American Indians in the production of their quill-work decoration, but the method of manufacture of this fillet is quite different. It does not appear to have been described so far, and seems to me to be worth calling attention to (Figs. 29 and 30).

The frame is merely a piece of a branch about 1 inch (or 2·5 cm.) in diameter, bent artificially into the shape of a bow, the chord being 23½ inches (or 60 cm.) long from tip to tip, with a depth of about 2¾ inches (or 7 cm.). There is a piece of folded, tanned (?) leather fixed at about 3 inches (or 7·5 cm.) distance from one end of the bow, being held in position on the one side by a tie of soft leather (buckskin), and on the other side by a set of twenty-eight pseudo-warp threads. The leather as folded measures 1⅞ × 1¼ inches (or 4·8 × 3·2 cm.). As will be seen directly, these apparently warp threads are only warp-thread supporters. All the threads consist of two lengths of non-coloured sinew twined together. One end of every thread is made fast at the warp end of the bow, passes through the pseudo-warp-spacer into the inside of the folded leather by means of a slit at the folding, passes

[1] "Moccasins and Their Quill Work," *Journ. Roy. Anthrop. Inst.*, xxxviii, 1908, pp. 47–57.

through the loop of the buckskin tie, and returns through the adjoining slit to the bow end it started from.

The pseudo-warps are kept in workable position by a pseudo-warp-spacer, which consists of a piece of birch bark 2 inches wide by $1\frac{1}{4}$ inches wide ($5{\cdot}1 \times 3{\cdot}2$ cm.), perforated with twenty-eight holes in the same horizontal line, the pseudo-warps passing through these holes. When all the pseudo-warps are in position the folded piece of leather is sewn up with a few sinew stitches.

The first transverse, which is only apparently the weft, consists of two pieces of red-stained sinew which are twined alternately under and over the pseudo-warps. Then the sinew from the spool, which is continuous and not stained in any

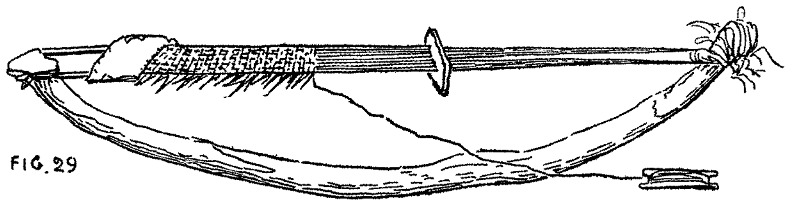


FIG. 29

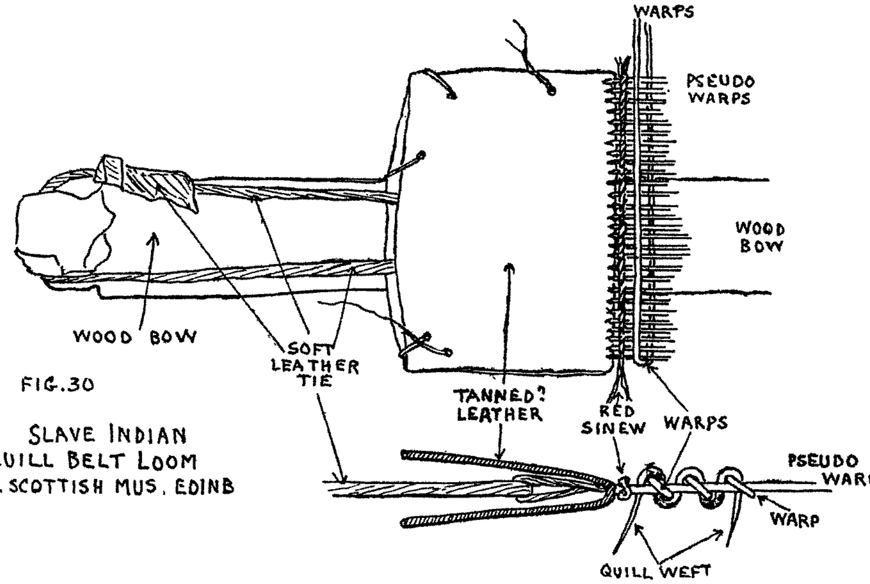


FIG. 30

SLAVE INDIAN QUILL BELT LOOM
ROY. SCOTTISH MUS. EDINB

way, is wound round the whole lot, forming a set of real warp threads at right angles to the pseudo-warps, both above and below them.

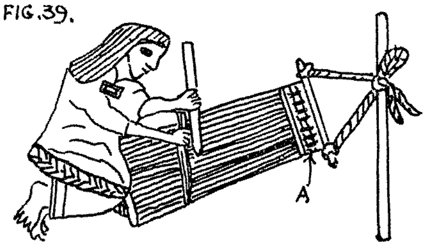
Variously coloured porcupine quills, which form the weft, are then inserted from below between the pseudo-warps, and bent into position over and under the warp, and so the fabric is made. By well pressing back the warp after the quill insertion, the upper and lower warp are brought into the same vertical plane and remain unseen. It is a very ingenious piece of work.

2. In the Cambridge Museum of Archæology and Ethnology there is a Kachiquel Indian loom brought over in 1885 by A. P. Maudsley. The interesting part about

it is that, after a start has been made at weaving at one of the beams for a length of 5 inches (or 13 cm.), a second start has been made at the other beam, which extends to a length of $20\frac{1}{2}$ inches (or 52 cm.); then there are the bare warps between the two webs for a distance of $54\frac{1}{2}$ inches (or 1·37 m.). From the second start the weaving would be continued until the two webs meet, where, owing to the difficulty of making a shed in the ever-narrowing space between the webs, the full quantity of picks could not be made, and hence there remains a coarseness or openness which is easily noticed. A piece of cloth so woven by the Hopi has been given to Bankfield Museum by Miss B. Freire-Marreco.

This method of a double start, which may be a substitute for laze-rods, appears to be an American characteristic, and is not modern, for it shows itself in the upper portion of the illustration (Fig. 39) of a loom in the Mendoza Codex as reproduced by Kingsborough. The dimensions of this Kachiquel loom are as follows: length from beam to beam inclusive, $78\frac{3}{4}$ inches (or 2 m.); the beams are of hard wood, 2·4 cm. (or about 1 inch) in diameter; there are 84 warp threads to the inch (or 33 to the cm.); the warp is woven double (*i.e.*, "sisters," two threads as one, but *not* of "doubled"[1] yarn); there are 30 picks to the inch (or 11·8 to the cm.); the weft is single except for about 14 picks at the heading and tailing. The temple (Fig. 36), or instrument for keeping the width of the web correct and the selvedges parallel, is made of a portion of a reed with a piece of needle stuck in at each end for fixing to the cloth. The temple is placed *underneath* the finished cloth. The spool is the primitive longitudinal type *A* of my diagram. The beater-in has a hard convex surface, tapers at both ends with irregular edges. The shed-stick is of cane, with Balfourian ornamentation at the node, gummed up at the end, and apparently filled with seed (?), which rattles when shaken. The "Oxford check" pattern on the cloth is obtained by means of red warp threads at intervals of 3·5 cm., crossed by red picks at intervals of 4 cm., for which a special red-yarn spool is provided.

FIG. 39.

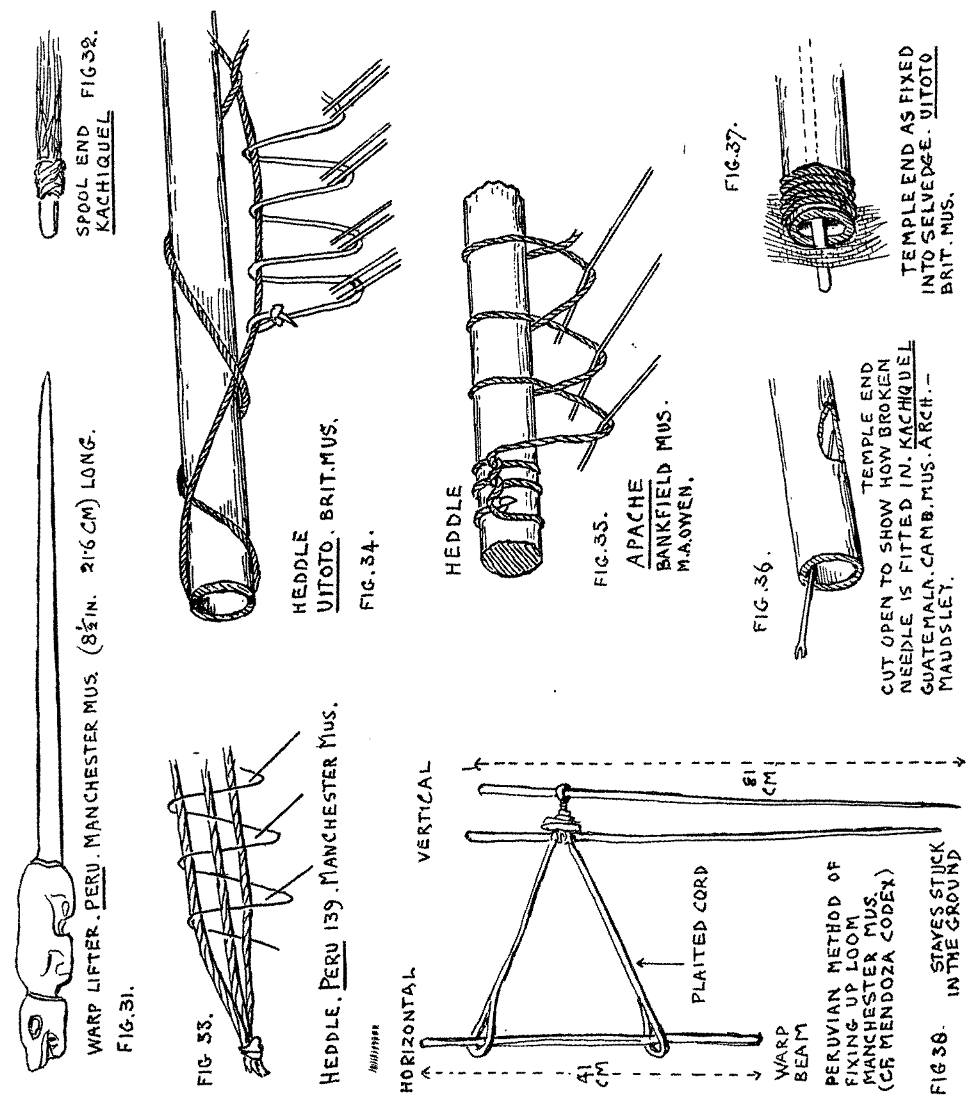


NAHUA (ANCIENT MEXICAN) GIRL WEAVING. MENDOZA CODEX, KINGSBOROUGH VOL. I. PL. 61. — NOTE THE BIT OF WEAVING AT THE WARP END A.

3. A loom from Uitoto, in the Peruvian part of the head of the Amazon district, and now in the British Museum, has two peculiarities worth mentioning. The heddle leashes, which are of the spiral form, instead of hanging direct from the heddle rod, hang from an attached cord (Fig. 34), and the temple (Fig. 37) consists of a piece of hollow cane with a loose very thin piece of cane running through it, the protruding ends of which are stuck into the finished portion of the web, practically similar to that of the above-mentioned Kachiquel loom. The dimensions are:

[1] "Doubled" is a term used to denote two or more threads twisted into one, and known as two-ply, three-ply, six-ply, etc.

length, beam to beam inclusive, about 14 feet (or 4·25 m.); width of web, 17½ inches (or 44·5 cm.); 64 warps to the inch (or 25·6 to the cm.); the warps are sisters, same as the Kachiquel warp; 25 picks to the inch (or 10 to the cm.); the wefts are single. Both warp and weft are continuous. The spool is of the primitive longitudinal type (*Aa*). The shed-stick is a palm midrib or stem.



4. A very interesting loom (Plate XII) is that brought from Mazatec, Arizona, by J. Cooper Clark, and now in the British Museum; for besides the plain up-and-down web, a large portion is devoted to twist or gauze[1] weaving, while a considerable piece of the plain web is afterwards covered by a woven-in design of dark blue

[1] Gauze, formed by crossing adjacent warp threads and bound by weft at the point of junction.

wool. Beginning at the breast beam, there are 10 plain picks, then 1 of gauze, then 4 more plain picks, whence the gauze weaving extends a length of about $8\frac{1}{2}$ inches (or 22 cm.), and on this is woven the pattern just mentioned; then we have a further 6·5 cm. (or $2\frac{5}{8}$ inches) of gauze; then 1·4 cm. (or $\frac{9}{16}$ inch) of plain weaving, followed by 7·6 cm. (or 3 inches) of gauze, and so on. The warp lay-out for accomplishing the gauze is shown in Fig. 41. It should be noted that on this loom, as on the Kachiquel loom, a piece of the tailing has been completed before the heading was started on. The dimensions are: length, beam to beam inclusive,

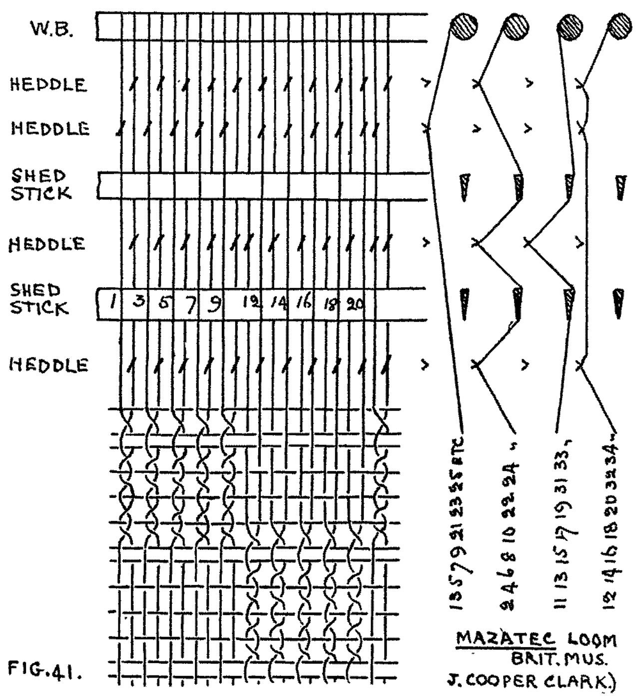


FIG. 41.

92 inches (or 2·35 m.); width of web, 19 inches (or 48·25 cm.). There are about 42 warp threads to the inch (or 16·5 to the cm.), and 24 picks of two threads each (*not* "doubled") to the inch (or 11·6 to the cm.). There are four heddles, the rods of which are 11, 9, 7 and 8 mm. respectively in diameter. With so many heddles, laze-rods may not be necessary, but amongst the loose sticks with the loom some may have served as laze-rods. Two fish-ribs are stuck into the cloth, probably for picking up missed threads. Form of spool is longitudinal, corresponding to form *Aa*. Crawford[1] mentions that gauze-weaving is common among Peruvian textiles.

5. In the Manchester University Museum there is an ancient Peruvian loom (marked "No. 139, Dr. Smithies") which calls for attention, as it exemplifies a method of pattern-weaving found also in Africa, to which I will refer later on, and

[1] "Peruvian Textiles," by M. D. C. Crawford (p. 98), *Anthrop. Papers, Amer. Mus. Nat. Hist.*, xii, pt. iii, New York, 1915.

to a lesser extent in, so far as I know, the Eastern Archipelago. This method consists in preparing the pattern in the warp so that the weaver not only has the pattern in front of him, but is also, by the arrangement of the warps, guided as to where the pattern is to be placed, and so ensuring regularity.

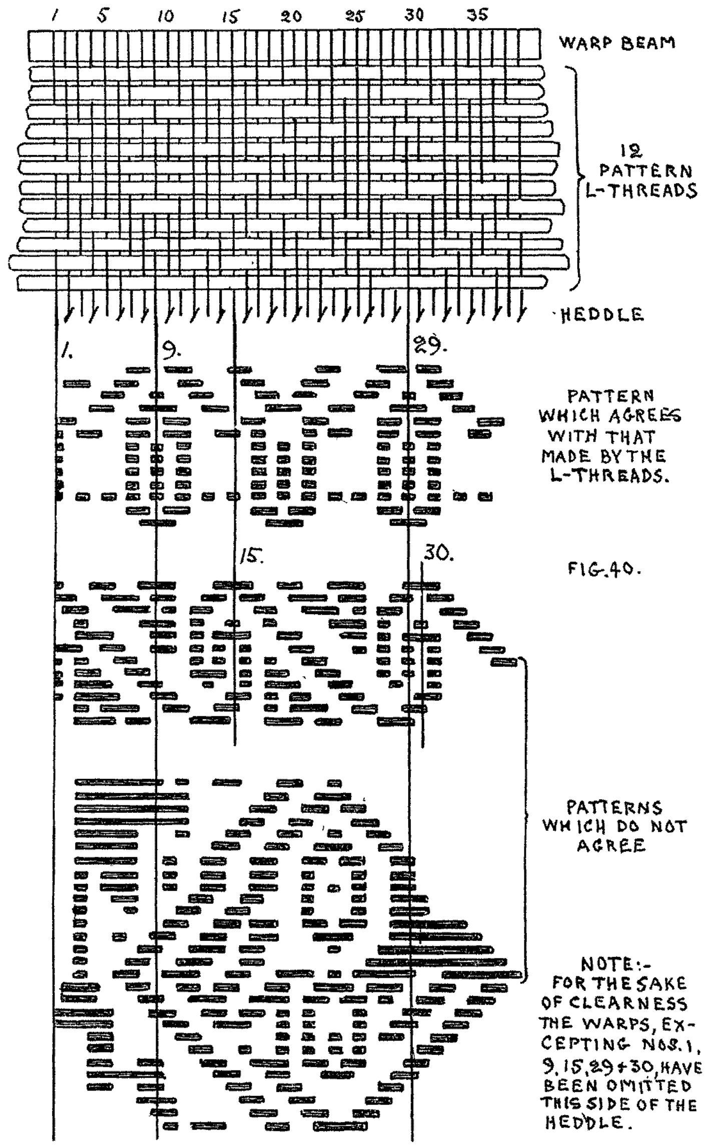
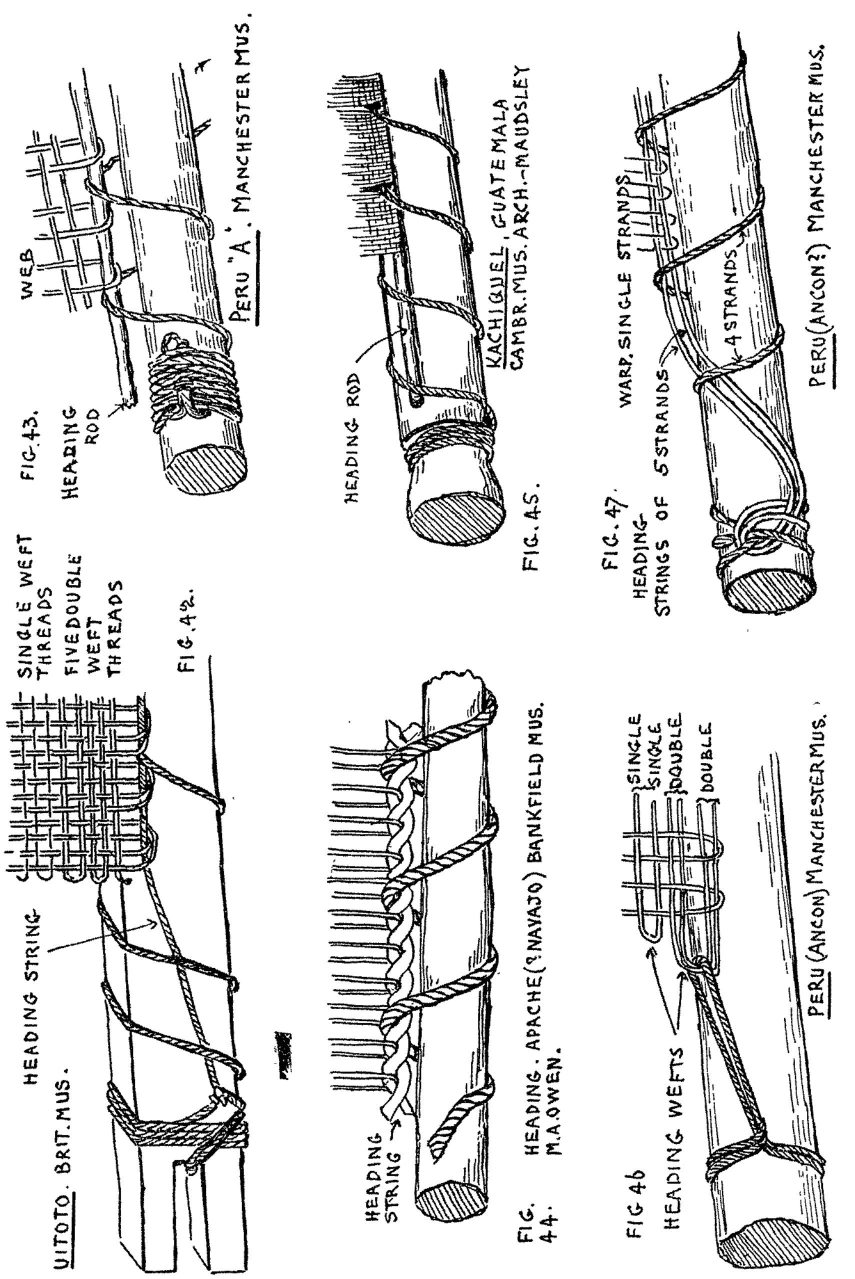


FIG. 40.

ANCIENT PERU. No 139. MANCHESTER MUSEUM

As will be seen from the diagram (Fig. 40), there are twelve pattern laze threads interlaced in the warp; by this regulated interlacing the pattern can be distinguished, and it is clearly reproduced in the web, in so far as that has been completed. It is probable that, as the weaving progressed, the pattern laze threads nearest the web, and therefore done with, would be removed, and if necessary re-inserted above the others in such new arrangement as might have been necessary. It will be noticed that the pattern commences to repeat itself at every twentieth warp. Not so, however, as regards the second pattern in the web, which repeats



itself at every fifteenth warp; hence the arrangement shown in the warp does not apply to the second one, and hence also it is obvious that for every different pattern there must be a different arrangement of the laze threads interlacing the warp.

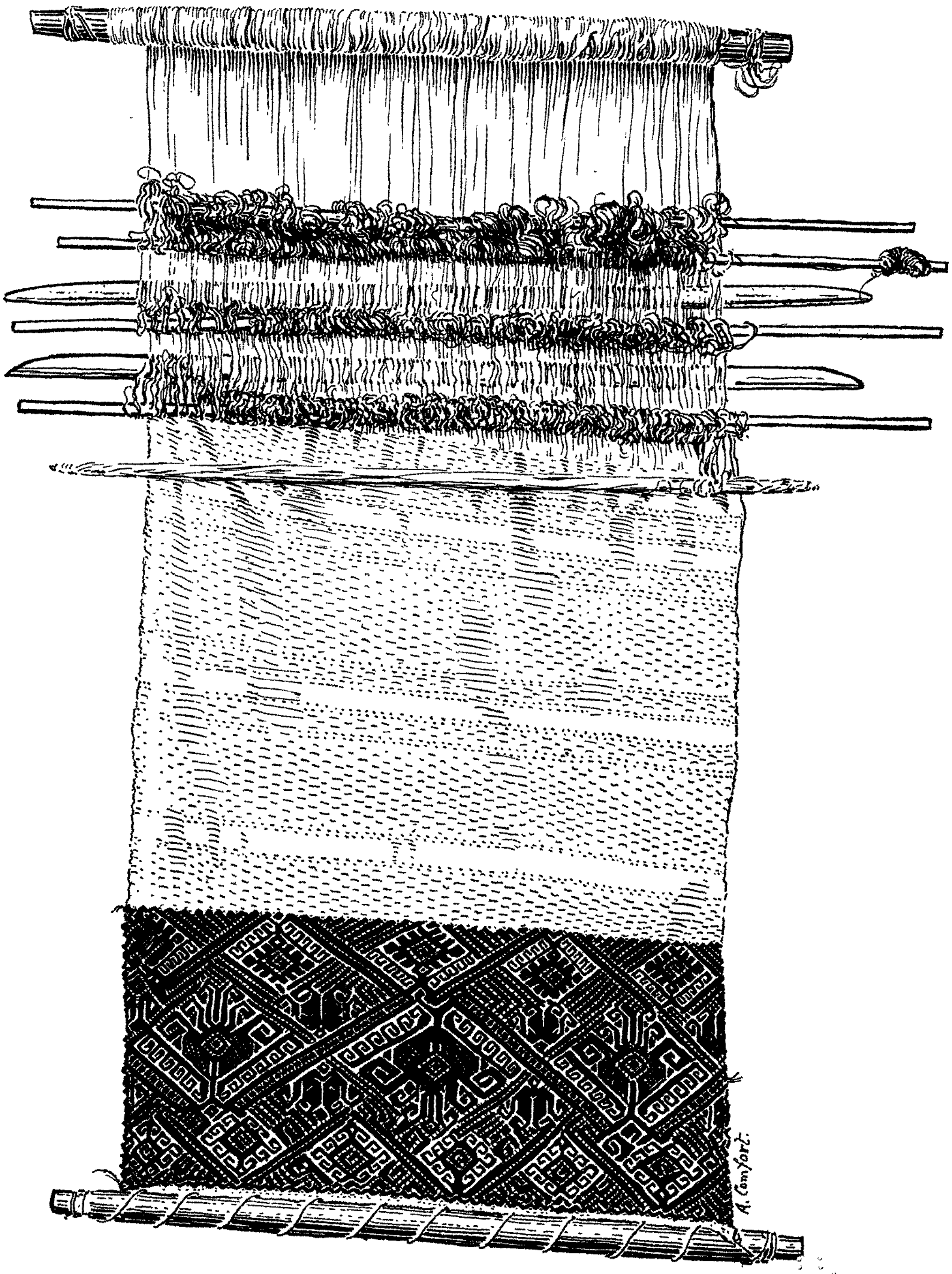
There is a third pattern which does not agree with either the first or the second, and there is also a fourth (in tapestry work, but not shown on the diagram), which likewise does not agree with the others. Crawford speaks of short pieces of cane found amongst the *débris* of Peruvian tombs and also on unfinished Peruvian looms which apparently serve the same purpose as these pattern laze threads. The heddle consists of three pieces of cord (Fig. 33) without any rod, nor is there anything to indicate that there ever was a rod.

The dimensions of this loom are: length, beam to beam inclusive, 22½ inches (or 57 cm.); width of web, 16½ inches (or 42 cm.); about 19 warps to the inch (or 7·5 to the cm.); 144 picks to the inch (or 57 to the cm.) in the plain web and 93 to the inch (or 37 to the cm.) in the pattern.

Among some loose weaving and spinning tools from ancient Peru in the Manchester Museum are some staves (Fig. 38), evidently for holding the loom in position while weaving is in progress, the warp end being fixed on to the staff and the breast beam being held by means of a waistband round the body of the kneeling Nahua weaver, as shown in the Mendoza Codex (Fig. 39). On one loom, marked "Apache" (? Navajo) in Bankfield Museum the heddle leashes are crossed spiral in form (Fig. 35).

There is in all these looms a very great diversity in the warp attachments to the breast beams or headings, as shown in Figs. 42–47. The warps are attached to a heading string or rod, which in turn is attached to the breast beam by a binding string. In one specimen (Fig. 44) the two heading cords are twisted so as to catch a warp loop at every twist, and so act as a warp spacer or laze rod, while in another (Fig. 40) the web commences without any heading string or rod at all. In none of them is the warp supported directly on the beam. Whether this is so in American looms in general I cannot say.

(Part II, "African Looms," to follow.)



MAZATEC LOOM. BRITISH MUSEUM (J. COOPER CLARK).